RAILWAY RAIL HANDLING APPARATUS AND METHOD

The present invention relates to railway rail handling apparatus and a method of handling railway rails using such apparatus.

Railway maintenance may involve replacing railway rails when they are worn. It is known within the railway maintenance industry to use apparatus that runs on an existing railway to lift worn rails and lay replacement rails. GB 1020111 and DD 102756 disclose such apparatus having a railway undercarriage with railway engaging wheels to allow the apparatus to run on an existing railway when in use. A disadvantage of such apparatus is that it needs to be lifted onto the railway to bring it into use.

An alternative approach is to use what is termed road-rail plant, such as that provided by Colmar and Atlas. Road-rail plant is termed as such because it is provided with both ground engaging wheels and railway engaging wheels so that it is capable of moving over the ground and along a railway. The road-rail plant is brought into use by driving the plant onto an existing railway by means of the ground-engaging wheels. The railway engaging wheels are then brought into engagement with the railway. In a typical railway rail replacement task, replacement rails are deposited by the side of the railway and the road-rail plant is used as it moves along the railway to move worn rails to one side of the railway and replacement rails into position before they are secured to the sleepers.

The present applicant has appreciated several shortcomings of road-rail plant, amongst which is the need to have the plant certified as on track plant. Certification as on track plant is normally a burdensome process involving compliance with safety measures, which can necessitate the inclusion of safety mechanisms on the plant.

The present invention has been devised in the light of this appreciation. In accordance with a first aspect of the invention there is provided railway rail handling apparatus configured for track side operation comprising ground engaging

wheel means and rail moving means, which is configured to engage a railway rail along part of its length, the rail moving means being further configured for its progressive movement longitudinally along the rail as the railway rail handling apparatus moves on the ground engaging wheel means and, as the rail moving means so moves, for progressive bending of the rail laterally of an unbent part of the rail to thereby move the rail from a first position to a second position, the railway rail handling apparatus defining a footprint over the ground, and the rail moving means being, in use, operative within the footprint.

The present invention represents a significant departure from conventional approaches to railway rail handling in that the present invention operates as track-side apparatus in contrast with conventional rail handling apparatus which is on track apparatus. Thus, in applying the present invention there is no requirement to obtain certification for on track operation or to lift the apparatus onto and off the railway. Therefore, there is less need for safety mechanisms, e.g. to provide braking means on apparatus that runs on railways. The reduced requirement for safety mechanisms can provide for a simpler, more lightweight apparatus. A further drawback of on track apparatus is that its usability can be limited. For example, road-rail plant may only be operable where there are two railways side-by-side: a first railway for the road-rail plant to run on and a second railway being worked on by the plant. The present invention has no requirement for two railways side-by-side.

Operation of the rail moving means within the footprint of the rail handling apparatus can provide for advantages over conventional approaches. Road-rail plant normally makes use of an extendible boom which reaches out to grab a rail, which is then raised by the boom and moved to another location. A counterbalance is usually required to neutralise the weight of the boom and the rail being moved. Such a counterbalance is typically of such a weight that the road-rail plant is unsuited to track side operation. This is because the road-rail plant tends to disturb the railway ballast, sink into the ground beside the railway or at least grip the ground in an unsatisfactory manner providing for uneven movement of the plant. Disturbance of the ballast supporting the railway sleepers is undesirable because it can necessitate time consuming work to remedy the disturbance. Operation within

the footprint according to the present invention reduces imbalances in the railway rail handling apparatus that may be caused by forces exerted in handling a rail, whereby the need for a counterbalance is at least reduced.

It is to be noted that progressive bending of the rail relies to a large extent on the inherent flexibility of the rail.

A maintenance operation may involve moving a worn railway rail, which is to be replaced, from a first position to a second position, e.g. from a railway to one side of the railway. Accordingly, the rail moving means may be configured to progressively bend the rail laterally over the ground.

In such a maintenance operation, in a form of the apparatus the railway rail handling apparatus may be positioned such that the rail moving means is located generally over the side of the railway to which it is desired to move the rail. Then an end of rail (e.g. a worn rail) may be bent towards and brought into engagement with the rail moving means. The bending of the end of the rail is made possible by the rail's inherent flexibility. When the end of the rail has been brought into engagement with the rail moving means, the rail moving means may be moved progressively and longitudinally along the rail. As the rail moving means moves progressively along the rail, it progressively bends successive parts of the rail laterally of an unbent part of the rail and in a direction away from the railway to move the rail to one side of the railway.

When the apparatus is used to move a replacement rail from one side of the railway onto the railway, the above described operation may be repeated starting with the rail moving means located generally over the position on the railway to where it is desired to move the replacement rail.

The rail moving means may be further configured to support a part of the rail above the ground. Thus, the railway rail handling apparatus may only need to support a part of the weight of a rail in addition to bearing forces exerted on the apparatus during bending of the rail. This is in contrast to the road-rail apparatus which normally lifts an entire rail off the ground and therefore has to bear the entire weight of the rail. Lifting an entire rail off the ground can bend the rail to quite a significant extent and thereby put undesirable strain on the rail. Supporting

a part of a rail can reduce the extent of bending and provide for a corresponding reduction in strain.

The railway rail handling apparatus may be configured for steering of the ground engaging wheel means over the ground.

More specifically, the railway rail handling apparatus may be configured for steering of the ground engaging wheel means over the ground in a direction laterally of the rail as the rail moving means moves along the rail. Lateral steering of the railway rail handling apparatus can allow for control of to where the rail is moved. For example, at the start of a rail moving operation the rail moving means may be positioned closer to an end of rail to be moved so that the end need not be bent to a large extent before it is brought into engagement with the rail moving means. Steering of the railway rail handling apparatus can then be used to compensate for positioning the rail moving means closer to the end of the rail by steering the apparatus such that the rail is moved to a desired position.

Alternatively or in addition, the railway rail handling apparatus may be configured to move only one rail from a first position to a second position at a time. Therefore, the railway rail handling apparatus may need to be only as wide as is required to straddle one rail. This can provide for a narrower apparatus compared with certain prior art apparatus, thereby providing for use in narrow railway cuttings, tunnels, etc. Also, the railway rail handling apparatus can be more readily transported from one site to another on account of its smaller width.

The apparatus may further comprise two spaced apart apparatus support members for supporting the apparatus over a railway, the rail moving means being located between the two apparatus support members. Thus, forces exerted on the rail moving means during bending of a rail can be distributed between the two apparatus support members. Where the rail moving means supports a rail above the ground, the weight of the rail borne by the rail moving means can be distributed between the two apparatus support members. The railway rail handling apparatus may be configured to distribute the weight substantially equally between the two apparatus support members. For example, the rail moving means may be locatable substantially half-way between the two apparatus support members.

More specifically, the apparatus may be configured such that the rail moving means depends between the apparatus support members. Thus, the apparatus may comprise a chassis means supported on the apparatus support members with the rail moving means depending from the chassis means. The apparatus support members may be of a length which, in use, elevates the chassis means above a railway by a distance sufficient allow the rail moving means to raise a rail above the ground for proper operation of the rail moving means. Typically, the apparatus support members raise the chassis means about 1m above a railway. Such forms of the invention may provide for railway rail handling apparatus of moderate height in contrast to known railway rail handling apparatus. The moderate height of such forms of the present invention may provide for easier operation in the vicinity of overhead structures, such as overhead power lines, tunnel roofs and bridges.

The chassis means may comprise a platform upon which to mount further components of the railway rail handling apparatus, such as apparatus control equipment, pneumatic devices and power generating equipment.

More specifically, the platform may define an aperture through which the rail moving means depends. Thus, the platform may be positioned nearer the ground without a reduction in the extent to which the rail moving means may engage with a rail above the ground. Having a lower platform can provide an operator who is working behind the railway rail with an improved field of view over the top of the apparatus.

The rail moving means may be configured to be extendible. Thus, an elevation over the ground of a rail supported by the rail moving means may be varied. More specifically, the rail moving means may be progressively extendible. Extendibility may be achieved by providing the rail moving means with a telescopic body.

In a form of the invention the railway rail handling apparatus may be configured for movement of the rail moving means on the railway rail handling apparatus laterally of a rail engaged in the rail moving means. Thus, the need to position the railway rail handling apparatus such that the rail moving means is located where it is desired to move the replacement rail may be reduced. Instead

the rail moving means may be positioned over the rail to be moved and when the end of the rail is engaged the rail moving means may be moved laterally on the railway rail handling apparatus to the desired position, perhaps as the railway rail handling apparatus moves over the ground. A further advantage is that a need to steer the rail handling apparatus, e.g. to avoid an obstacle, may be reduced. Thus disturbance of ballast can be minimised.

More specifically, the railway rail handling apparatus may be configured such that a part of the rail moving means that engages a rail describes a substantially linear path as it moves on the railway rail handling apparatus.

Alternatively or in addition, the rail moving means may be configured to swivel in relation to the railway rail handling apparatus. The rail moving means may have an elongate body, with a first end of the elongate body mounted to swivel on the apparatus and a second opposite end of the elongate body configured to engage a rail. Thus, swivelling of the rail moving means can bring it closer to an end of a rail at the start of a rail moving operation. This can have the advantage of reducing the extent to which the rail needs to be bent before it engages with the rail moving means. Configuring the rail moving means for extendibility can also help bring the rail moving means closer to the end of the rail at the start of a rail moving operation.

Alternatively or in addition, the rail moving means may comprise user operable arresting means for arresting movement of the rail moving means in relation to the apparatus in a direction lateral of a rail. Thus, when an end of a rail has been brought into engagement with the rail moving means the arresting means may be operated to prevent further lateral movement of the rail moving means in relation to the apparatus. For example, the arresting means may be a pin or the like that a user inserts into the rail moving means to prevent it from swivelling in relation to the apparatus.

The rail moving means may be configured for rotational movement in relation to the railway rail handling apparatus about an axis extending from the ground, when the railway rail handling apparatus is in use, and substantially perpendicular to a longitude of a rail engaged by the rail moving means. In use, the

rail moving means can rotate to a position in relation to the railway rail handling apparatus to suit an angle to which the rail is to be or is being bent.

The rail moving means may define an aperture for receiving a rail lengthwise. More specifically, the aperture may be of sufficient dimensions to accommodate discontinuities and projections encountered on a surface of a rail, such as bolts, weld seams and fissures.

More specifically and according to a first form of the invention, the rail moving means may be configured to completely encircle the part of the length of rail engaged by the rail moving means. This can have the advantage, in comparison with known rail grab devices and the like, of providing for secure engagement of the rail. For example, a rail moving means according to the first form of the invention is less likely to drop a rail on encountering discontinuities and projections on the surface of the rail.

More specifically, the rail moving means may have a gate means moveable to allow a rail to be received by the rail moving means. Thus, the gate means may be moved at the start of a rail moving operation to permit reception and engagement of a rail by the rail moving means. For example, the gate means may be mounted for rotation on a rotatable mounting. The gate means may have locking means for locking the gate means in a closed position.

The rail moving means may be configured for ease of its movement longitudinally along a rail engaged by the rail moving means. The rail moving means may be configured for ease of movement by means of one or more devices that engage with the rail, such as rollers, bearings, low friction surfaces, etc.

The apparatus may be configured to provide a rigid connection to the rail moving means at least in a direction lateral of a rail engaged in the rail moving means. Thus, a force for bending a rail may be properly and controllably transmitted from the apparatus to the rail moving means.

The railway rail handling apparatus may further comprise railway rail raising means. The railway rail raising means may be used to help raise an end of a rail towards the rail moving means, for example at the start of a rail moving operation. The raising means may, for example, comprise a block and tackle arrangement.

The railway rail handling apparatus may comprise two spaced apart apparatus support members for supporting the apparatus over a railway and the ground engaging wheel means may be provided on the apparatus support means.

The ground engaging wheel means may comprise a continuous chain tread means. A continuous chain tread means can provide for distribution of the weight of the railway rail handling apparatus, which can be advantageous when the apparatus is moving over ballast.

More specifically, the continuous chain tread means may be of a length at least as great as a standard spacing of railway sleepers. Thus, at least some of the weight of the railway rail handling apparatus may be borne by the railway sleepers thereby reducing the likelihood of disturbing the ballast.

Where the railway rail handling apparatus comprises two continuous chain tread means, the two continuous chain tread means may be spaced apart to substantially the same extent as a standard rail to rail spacing. This can allow for the spaced apart continuous chain tread means to move over the ground close to the rails where the ballast is closer packed and less liable to disturbance.

The railway rail handling apparatus may comprise pneumatic systems for actuating one or more moving parts of the apparatus.

The railway rail handling apparatus may be configured to be self-propelled.

More specifically, the railway rail handling apparatus may comprise an engine, e.g. such as a diesel engine, configured to provide motive power for the railway rail handling apparatus.

The railway rail handling apparatus may comprise a generator for providing power to actuate one or more moving parts of the apparatus. More specifically the generator may comprise a diesel generator.

The railway rail handling apparatus may comprise user control means for user control of the apparatus.

One or more of the component parts of the railway rail handling apparatus may be formed of metal, such as steel.

According to a second aspect of the present invention, there is provided a method of handling a railway rail by means of a railway rail handling apparatus,

which is configured for track side operation and comprises ground engaging wheel means, the method comprising engaging a railway rail along part of its length by a rail moving means of the railway rail handling apparatus, and moving the railway rail handling apparatus on the ground engaging wheel means to progressively move the rail moving means longitudinally along the rail to progressively bend the rail laterally of an unbent part of the rail to thereby move the rail from a first position to a second position, in which the rail moving means is operated within a footprint over the ground of the railway rail handling apparatus.

Forms of the second aspect of the invention may comprise one or more of the features described above in relation to the first aspect of the invention.

The present applicant has realised that a rail moving means according to the first form of the invention defined above may have wider application than hitherto described. Thus, according to a third aspect of the present invention there is provided a railway rail handling device, which is configured to receive a railway rail lengthwise and to engage the rail along part of its length and for progressive, longitudinal movement along the received rail and, as it so moves, for progressive bending of the rail laterally of an unbent part of the rail, the device being further configured to completely encircle the part of the length of rail engaged by the device.

A railway rail handling device according to the third aspect of the invention can have the advantage, in comparison with known handling devices, such as a rail grab device of a road-rail plant, of providing for secure support of a rail. For example, a railway rail handling device according to the third aspect of the invention is less likely to drop a rail on encountering discontinuities and projections on the surface of the rail, such as bolts, weld seams and fissures.

Forms of the third aspect of the invention may comprise one or more of the features described above in relation to the first and second aspects of the invention.

According to a fourth aspect of the present invention, there is provided a railway rail handling apparatus, as defined below, having a railway rail handling device according to the third aspect of the present invention.

For the purpose of the fourth aspect of the present invention, railway rail handling apparatus is defined as comprising a railway rail handling apparatus

according to the first aspect of the present invention, known road-rail plant as described hereinabove and other such prior art forms of railway rail handling apparatus.

A specific embodiment of the present invention will now be described by way of example only and with reference to the following drawings, in which:

Figure 1a is a side view of a railway rail handling apparatus according to the invention;

Figure 1b is a front view of the railway rail handling apparatus of Figure 1a;

Figure 2 is a detailed front view of the rail moving means of Figures 1a and 1b when open to receive a rail;

Figure 3a is a side view of the railway rail handling apparatus of Figure 1a when engaged with a rail;

Figure 3b is a front view of the railway rail handling apparatus of Figure 1b when engaged with an end of a rail;

Figure 4 is a plan view of the apparatus of Figures 1a to 3b in operation; and

Figures 5a and 5b are views of an alternative embodiment of the railway rail handling apparatus.

Referring to the drawings, Figures 1a and 1b respectively provide side and front views of a railway rail handling apparatus 10 according to the invention. The apparatus 10 comprises rail moving means 12, which is located approximately half way between and depends between two spaced apart apparatus support members 14, 16. The rail moving means 12 depends from a chassis 18, which is supported on the two spaced apart apparatus support members 14, 16. On the chassis 18 are supported a pneumatic system 20, a diesel generator 22 and a user control 24, which provide pneumatic actuation, generation and user control of the railway rail handling apparatus in accordance with known techniques. The diesel generator provides motive power for the railway rail handling apparatus. In addition, a block and tackle arrangement 26 is mounted on the front of the chassis 18. The block and tackle arrangement can be moved to one of several positions between the spaced apart support members 14, 16. A continuous chain tread 28 (which

constitutes ground engaging wheel means) is provided at the end of each of the two spaced apart apparatus support members 14, 16.

Figure 2 shows the rail moving means 12 of Figures 1a and 1b in more detail. With reference to Figures 1a, 1b and 2, the rail moving means comprises an elongate telescopic body 40, having a first part 42 that is telescopically received in a second part 44. Referring now again to Figures 1a and 1b, the upper end of the body 40 is mounted on the chassis 18 by means of a coupling 46, which provides for swivelling and/or rotation of the rail moving means in relation to the chassis. A pin (not shown and which constitutes arresting means) is inserted by an operator into an upper part of the rail moving means to arrest swivelling and/or rotation in relation of the chassis.

At the end of the rail moving means 12 opposite the end having the coupling 46, the rail moving means is configured to define an aperture 48 for receiving a rail. The aperture 48 is defined by two spaced apart side members 50, 52, a plate 54 substantially perpendicular to the spaced apart side members 50, 52 and a roller 56 (which constitutes a gate means) spaced apart from the plate. The aperture is of sufficient dimensions to accommodate discontinuities and projections encountered on a surface of a rail, as the rail moving means is moved along the rail. As can be seen from Figure 2, the side members 50, 52 can be rotated in the direction of the arrows. As the roller 56 is attached to one of the side members 50, rotation of that side member 50 swivels the roller 56 to one side, thereby permitting a rail to be received between the side members from below. When the roller 56 is in the closed position shown in Figure 1a, a retractable bolt 58 provided on the roller 56 is received in a corresponding locking aperture 60 provided in one of the side members 52.

As shown in Figure 2, two rotatable handle supports 62, 64 are provided on the top of the plate 54, with a handle 66 extending from a side of one of the handle supports 62. The handle supports 62, 64 and handle 66 are not shown in Figures 1a and 1b for the sake of clarity. The handle supports can be rotated sideways, as shown in Figure 2. The handle supports 62, 64 may be rotated independently of the side members 50, 52; alternatively, the side members and handle supports may be in mechanical communication such that a handle support will rotate with its

corresponding side member. When the two handle supports 62, 64 are rotated towards each other such that they extend forward of the rail moving means 12, the handle 66 that extends from one of the handle supports 62 engages with the other handle support 64 to provide a convenient operator handle, which extends across the front of the rail moving means 12.

Structural parts of the railway rail handling apparatus, such as the chassis 18, the support members 14, 16, the block and tackle arrangement 26, the rail moving means 12, etc, are largely formed of a metal, such steel. The continuous chain tread 28 may be formed of rubber, plastics or similar such material.

A height of the railway rail handling apparatus 10 from the ground to the chassis 18, when the apparatus is standing on the continuous chain tread 28 is about 1m. A width of the chassis 18 from one support member to the other 14, 16 is about 1m. A length of the apparatus from the front of the continuous chain tread to its rear is about 1.7m and the length of the chassis is about 1m. The rail moving means has a diameter of about 0.2m. The length of the rail moving means in the fully retracted state is about 0.7m and in the fully extended state is about 0.9m. The aperture defined by the rail moving means for receiving a rail is about 0.2m high and 0.2m wide.

Turning now to Figures 3a, 3b and 4, it will be seen that these figures illustrate a use of the apparatus shown in Figures 1a, 1b and 2. Accordingly, the reader is directed to the description given with reference to Figures 1a, 1b and 2 in the preceding paragraphs for a description of those components that are common to Figures 3a to 4.

Referring to Figures 3a, 3b and 4, use of the railway rail handling apparatus will now be described. The railway rail handling apparatus 10 is manoeuvred over the ground by means of the continuous chain tread 28 so that the rail moving means 12, when substantially vertical to the ground, is over a location (e.g. part of a railway) to which it is desired to move a rail. The side members 50, 52 and the rotatable handle supports are rotated to take up the position shown in Figure 2. The pin, which is used to arrest swivelling of the rail moving means is removed. In addition, the block and tackle arrangement 26 is moved to a position between the two spaced apart members 14, 16, which is above or at least as close

as possible to a rail 80 lying on the ground. Then, the rail moving means 12 is swivelled sideways towards the rail 80 and, at much the same time, the block and tackle arrangement 26 used to raise an end 82 of the rail above the ground and towards the open end of the rail moving means 12. If need be, an operator may use the inherent flexibility of the rail to bend the end of the rail laterally towards the rail moving means, e.g. by means of a crowbar or other such tool. The rail moving means 12 and the end 82 of the rail are manoeuvred so that the end 82 is received in the aperture 48 defined by the side members 50, 52 of the rail moving means 12. The telescopic body 40 of the rail moving means 12 may be extended or retracted to aid location of the end 82 of the rail in the aperture 48.

When the end 82 of the rail is properly received in the aperture 48, the side members 50, 52 (along with the handle supports 62, 64) are rotated to close the rail moving means 12 so that that they take up the position shown in Figures 3a and 3b. The block and tackle arrangement 26 can now be disengaged from the end of the rail. In this position, the retractable bolt 58 is received in the corresponding locking aperture to hold the side members 50, 52 and roller 56 securely in place. Thus, as shown in Figure 3b, the rail moving means completely encircles the end 82 of the rail. The end 82 of the rail on the roller 56 and thus part of the rail (see Figure 3a) is supported above the ground. The set-up procedure concludes with the rail moving means 12 being swivelled back to be substantially vertical to the ground and the pin re-inserted to arrest further swivelling of the rail moving means 12 in relation to the chassis 18. This concludes the set-up procedure.

Upon conclusion of the set-up procedure, the railway rail handling apparatus 10 is driven on the continuous chain tread 28 so that the rail moving means 12 moves longitudinally along the rail 80. The presence of the roller 56 provides for ease of movement of the rail moving means along the rail. Rotation of the rail moving means 12 in relation to the chassis 18 about an axis extending substantially vertically from the ground can ease travel of the rail moving means along the rail.

Figure 4 provides a plan view of the railway rail handling apparatus 10 in operation, with the arrow indicating the direction of movement of the apparatus along the rail 80. As the apparatus 10 moves progressively along the rail, the rail

moving means 12 engages with successive parts of the rail to bend them laterally of the as yet unbent part of the rail in a continuous manner. The bending of the rail is made possible by its inherent flexibility. Thus, the rail is progressively moved from its initial location to a location generally below the rail moving means 12. This operation continues until the end of the rail is reached. Steering of the apparatus can be achieved by independent control of the two continuous chain treads 28. Steering allows an operator to control to where the rail is moved. Typically, the rail moving means 12 is disengaged from the rail by driving the apparatus 10 until the furthest end of the rail is reached and the furthest end drops from the rail moving means. As may be best appreciated by viewing Figure 4, the rail moving means 12 is operative within a footprint defined by the railway rail handling apparatus 10 over the ground.

Figures 5a and 5b are partial side and plan views of an alternative embodiment of the railway rail handling apparatus, in which the chassis 18 defines an aperture 19 through which the rail moving means 40 depends. As can be seen from Figure 5a the rail moving means 12 extends above the chassis, thereby allowing for the support members 14, 16 to be shortened and the height of the apparatus to be reduced. The rail moving means 12 is movable to and fro laterally of a rail engaged by the rail moving means in the aperture 19 (as indicated by the arrows of Figure 5b). The rail moving means 12 moves to and fro on a train (not shown) under power provided by the diesel generator. This embodiment provides several advantages. More specifically, the rail moving means 12 can be moved laterally during engagement of a rail with the rail moving means. In addition, the rail moving means can be moved laterally during bending of a rail, e.g. to avoid an obstacle, without disturbing ballast by having to steer the railway rail handling apparatus 10 on the continuous chain tread 28. Furthermore, the rail moving means can be moved laterally to control a position to where a rail is being moved by the railway rail handling apparatus.